Underdiagnosis bias of artificial intelligence algorithms applied to chest radiographs in under-served patient populations

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Abstract

Artificial intelligence (AI) systems have increasingly achieved expert-level performance in medical imaging applications. However, there is growing concern that such AI systems may reflect and amplify human bias, and reduce the quality of their performance in historically under-served populations such as female patients, Black patients, or patients of low socioeconomic status. Such biases are especially troubling in the context of underdiagnosis, whereby the AI algorithm would inaccurately label an individual with a disease as healthy, potentially delaying access to care. Here, we examine algorithmic underdiagnosis in chest X-ray pathology classification across three large chest X-ray datasets, as well as one multi-source dataset. We find that classifiers produced using state-of-the-art computer vision techniques consistently and selectively underdiagnosed under-served patient populations and that the underdiagnosis rate was higher for intersectional under-served subpopulations, for example, Hispanic female patients. Deployment of AI systems using medical imaging for disease diagnosis with such biases risks exacerbation of existing care biases and can potentially lead to unequal access to medical treatment, thereby raising ethical concerns for the use of these models in the clinic. Artificial intelligence algorithms trained using chest X-rays consistently underdiagnose pulmonary abnormalities or diseases in historically under-served patient populations, raising ethical concerns about the clinical use of such algorithms.